

7.0 Sites Containing Radioactive Substances.

In general, radioactive substances are hazardous substances under CERCLA and should be considered in HRS scoring. Releases of certain radioactive substances are, however, excluded from the definition of

"release" in section 101(22) of CERCLA, as amended, and should not be considered in HRS scoring.

Evaluate sites containing radioactive substances using the instructions specified in sections 2 through 6, supplemented by the instructions in this section. Those factors

denoted with a "yes" in Table 7-1 are evaluated differently for sites containing radioactive substances than for sites containing only nonradioactive hazardous substances, while those denoted with a "no" are not evaluated differently and are not addressed in this section.

TABLE 7-1.—HRS FACTORS EVALUATED DIFFERENTLY FOR RADIONUCLIDES

Ground water pathway	Status ^a	Surface water pathway	Status ^a	Soil exposure pathway	Status ^a	Air pathway	Status ^a
Likelihood of Release		Likelihood of Release		Likelihood of Exposure		Likelihood of Release	
Observed Release.....	Yes	Observed Release.....	Yes	Observed Contamination.....	Yes	Observed Release.....	Yes
Potential to Release.....	No	Potential to Release.....	No	Attractiveness/Accessibility.....	No	Gas Potential to Release.....	No
Containment.....	No	Overland Flow Containment.....	No	to Nearby Residents.....		Gas Containment.....	No
Net Precipitation.....	No	Runoff.....	No	Area of Contamination.....	No	Gas Source Type.....	No
Depth to Aquifer.....	No	Distance to Surface Water.....	No			Gas Migration Potential.....	No
Travel Time.....	No	Flood Frequency.....	No			Particulate Potential to Release.....	No
		Flood Containment.....	No			Particulate Containment.....	No
						Particulate Source Type.....	No
						Particulate Migration Potential.....	No
Waste Characteristics		Waste Characteristics		Waste Characteristics		Waste Characteristics	
Toxicity.....	Yes	Toxicity/Ecotoxicity.....	Yes/Yes	Toxicity.....	Yes	Toxicity.....	Yes
Mobility.....	No	Persistence/Mobility.....	Yes/No	Hazardous Waste Quantity.....	Yes	Mobility.....	No
Hazardous Waste Quantity.....	Yes	Bioaccumulation Potential.....	No			Hazardous Waste Quantity.....	Yes
		Hazardous Waste Quantity.....	Yes				
Targets		Targets		Targets		Targets	
Nearest Well.....	Yes ^b	Nearest Intake.....	Yes ^b	Resident Individual.....	Yes ^b	Nearest Individual.....	Yes ^b
Population.....	Yes ^b	Drinking Water Population.....	Yes ^b	Resident Population.....	Yes ^b	Population.....	Yes ^b
Resources.....	No	Resources.....	No	Workers.....	No	Resources.....	No
Wellhead Protection Area.....	No	Sensitive Environments.....	Yes ^b	Resources.....	No	Sensitive Environments.....	No
		Human Food Chain Individual.....	Yes ^b	Terrestrial Sensitive Environments.....	No		
		Human Food Chain Population.....	Yes ^b				
				Nearby Individual.....	No		
				Population Within 1 Mile.....	No		

^a Factors evaluated differently are denoted by "yes"; factors not evaluated differently are denoted by "no."
^b Difference is in the determination of Level I and Level II concentrations.

In general, sites containing mixed radioactive and other hazardous substances involve more evaluation than sites containing only radionuclides. For sites containing mixed radioactive and other hazardous substances, HRS factors are evaluated based on considerations of both the radioactive substances and the other hazardous substances in order to derive a single set of factor values for each factor category in each of the four pathways. Thus, the HRS score for these sites reflects the combined potential hazards posed by both the radioactive and other hazardous substances.

Section 7 is organized by factor category, similar to sections 3 through 6. Pathway-specific differences in evaluation criteria are specified under each factor category, as appropriate. These differences apply largely to the soil exposure pathway and to sites containing mixed radioactive and other hazardous substances. All evaluation criteria specified in sections 2 through 6 must be met, except where modified in section 7.

7.1 Likelihood of release/likelihood of exposure. Evaluate likelihood of release for the three migration pathways and likelihood of exposure for the soil exposure pathway as

specified in sections 2 through 6, except: establish an observed release and observed contamination as specified in section 7.1.1. When an observed release cannot be established for a migration pathway, evaluate potential to release as specified in section 7.1.2. When observed contamination cannot be established, do not evaluate the soil exposure pathway.

7.1.1 Observed release/observed contamination. For radioactive substances, establish an observed release for each migration pathway by demonstrating that the site has released a radioactive substance to the pathway (or watershed or aquifer, as appropriate); establish observed contamination for the soil exposure pathway as indicated below. Base these demonstrations on one or more of the following, as appropriate to the pathway being evaluated:

• **Direct observation:**

—For each migration pathway, a material that contains one or more radionuclides has been seen entering the atmosphere, surface water, or ground water, as appropriate, or is known to have entered ground water

or surface water through direct deposition, or

—For the surface water migration pathway, a source area containing radioactive substances has been flooded at a time that radioactive substances were present and one or more radioactive substances were in contact with the flood waters.

• **Analysis of radionuclide concentrations in samples appropriate to the pathway (that is, ground water, soil, air, surface water, benthic, or sediment samples):**

—For radionuclides that occur naturally and for radionuclides that are ubiquitous in the environment:

—Measured concentration (in units of activity, for example, pCi per kilogram [pCi/kg], pCi per liter [pCi/l], pCi per cubic meter [pCi/m³]) of a given radionuclide in the sample are at a level that:

—Equals or exceeds a value 2 standard deviations above the mean site-specific background concentration for that

- radionuclide in that type of sample, or
- Exceeds the upper-limit value of the range of regional background concentration values for that specific radionuclide in that type of sample.
- Some portion of the increase must be attributable to the site to establish the observed release (or observed contamination), and
- For the soil exposure pathway only, the radionuclide must also be present at the surface or covered by 2 feet or less of cover material (for example, soil) to establish observed contamination.
- For man-made radionuclides without ubiquitous background concentrations in the environment:
- Measured concentration (in units of activity) of a given radionuclide in a sample equals or exceeds the sample quantitation limit for that specific radionuclide in that type of media and is attributable to the site.
- However, if the radionuclide concentration equals or exceeds its sample quantitation limit, but its release can also be attributed to one or more neighboring sites, then the measured concentration of that radionuclide must also equal or exceed a value either 2 standard deviations above the mean concentration of that radionuclide contributed by those neighboring sites or 3 times its background concentration, whichever is lower.
- If the sample quantitation limit cannot be established:
- If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the sample quantitation limit in establishing an observed release (or observed contamination).
- If the sample analysis is not performed under the EPA Contract Laboratory Program, use the detection limit in place of the sample quantitation limit.
- For the soil exposure pathway only, the radionuclide must also be present at the surface or covered by 2 feet or less of cover material (for example, soil) to establish observed contamination.
- * Gamma radiation measurements (applies only to observed contamination for the soil exposure pathway):
- The gamma radiation exposure rate, as measured in microrentgens per hour ($\mu\text{R/hr}$) using a survey instrument held 1 meter above the ground surface (or 1 meter away from an aboveground source), equals or exceeds 2 times the site-specific background gamma radiation exposure rate.

Some portion of the increase must be attributable to the site to establish observed contamination. The gamma-emitting radionuclides do not have to be within 2 feet of the surface of the source.

For the three migration pathways, if an observed release can be established for the pathway (or aquifer or watershed, as appropriate), assign the pathway (or aquifer or watershed) an observed release factor value of 550 and proceed to section 7.2. If an observed release cannot be established, assign an observed release factor value of 0 and proceed to section 7.1.2.

For the soil exposure pathway, if observed contamination can be established, assign the likelihood of exposure factor for resident population a value of 550 if there is an area of observed contamination in one or more locations listed in section 5.1; evaluate the likelihood of exposure factor for nearby population as specified in section 5.2.1; and proceed to section 7.2. If observed contamination cannot be established, do not evaluate the soil exposure pathway.

At sites containing mixed radioactive and other hazardous substances, evaluate observed release (or observed contamination) separately for radionuclides as described in this section and for other hazardous substances as described in sections 2 through 6.

For the three migration pathways, if an observed release can be established based on either radionuclides or other hazardous substances, or both, assign the pathway (or aquifer or watershed) an observed release factor value of 550 and proceed to section 7.2. If an observed release cannot be established based on either radionuclides or other hazardous substances, assign an observed release factor value of 0 and proceed to section 7.1.2.

For the soil exposure pathway, if observed contamination can be established based on either radionuclides or other hazardous substances, or both, assign the likelihood of exposure factor for resident population a value of 550 if there is an area of observed contamination in one or more locations listed in section 5.1; evaluate the likelihood of exposure factor for nearby population as specified in section 5.2.1; and proceed to section 7.2. If observed contamination cannot be established based on either radionuclides or other hazardous substances, do not evaluate the soil exposure pathway.

7.1.2 Potential to release. For the three migration pathways, evaluate potential to release for sites containing radionuclides in the same manner as specified for sites containing other hazardous substances. Base the evaluation on the physical and chemical properties of the radionuclides, not on their level of radioactivity.

For sites containing mixed radioactive and other hazardous substances, evaluate potential to release considering radionuclides and other hazardous substances together. Evaluate potential to release for each migration pathway as specified in sections 3, 4, or 6, as appropriate.

7.2 Waste characteristics. For radioactive substances, evaluate the human toxicity factor, the ecosystem toxicity factor, the

surface water persistence factor, and the hazardous waste quantity factor as specified in the following sections. Evaluate all other waste characteristic factors as specified in sections 2 through 6.

7.2.1 Human toxicity. For radioactive substances, evaluate the human toxicity factor as specified below, not as specified in section 2.4.1.1.

Assign human toxicity factor values to those radionuclides available to the pathway based on quantitative dose-response parameters for cancer risks as follows:

- Evaluate radionuclides only on the basis of carcinogenicity and assign all radionuclides to weight-of-evidence category A.

- Assign a human toxicity factor value from Table 7-2 to each radionuclide based on its slope factor (also referred to as cancer potency factor).

- For each radionuclide, use the higher of the slope factors for inhalation and ingestion to assign the factor value.

- If only one slope factor is available for the radionuclide, use it to assign the toxicity factor value.

- If no slope factor is available for the radionuclide, assign that radionuclide a toxicity factor value of 0 and use other radionuclides for which a slope factor is available to evaluate the pathway.

- If all radionuclides available to a particular pathway are assigned a human toxicity factor value of 0 (that is, no slope factor is available for all the radionuclides), use a default human toxicity factor value of 1,000 as the human toxicity factor value for all radionuclides available to the pathway.

At sites containing mixed radioactive and other hazardous substances, evaluate the toxicity factor separately for the radioactive and other hazardous substances and assign each a separate toxicity factor value. This applies regardless of whether the radioactive and other hazardous substances are physically separated, combined chemically, or simply mixed together. Assign toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in section 2.4.1.1.

At sites containing mixed radioactive and other hazardous substances, if all radionuclides available to a particular pathway are assigned a human toxicity factor value of 0, use a default human toxicity factor value of 1,000 for all those radionuclides even if nonradioactive hazardous substances available to the pathway are assigned human toxicity factor values greater than 0. Similarly, if all nonradioactive hazardous substances available to the pathway are assigned a human toxicity factor value of 0, use a default human toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned human toxicity factor values greater than 0.

7.2.2 Ecosystem toxicity. For the surface water environmental threat (see sections 4.1.4 and 4.2.4), assign an ecosystem toxicity factor value to radionuclides (alone or combined chemically or mixed with other hazardous substances) using the same slope factors and

procedures specified for the human toxicity factor in section 7.2.1, except: use a default of 100, not 1,000, if all radionuclides eligible to be evaluated for ecosystem toxicity receive an ecosystem toxicity factor value of 0.

TABLE 7-2.—TOXICITY FACTOR VALUES FOR RADIONUCLIDES

Cancer slope factor * (SF) (pCi) ⁻¹	Assigned value
$3 \times 10^{-11} < SF$	10,000
$3 \times 10^{-12} \leq SF < 3 \times 10^{-11}$	1,000
$SF < 3 \times 10^{-12}$	100
SF not available for the radionuclide	0

* Radionuclide slope factors are estimates of age-averaged, individual lifetime total excess cancer risk per picocurie of radionuclide inhaled or ingested.

At sites containing mixed radioactive and other hazardous substances, evaluate the ecosystem toxicity factor separately for the radioactive and other hazardous substances and assign each a separate ecosystem toxicity factor value. This applies regardless of whether the radioactive and other hazardous substances are physically separated, combined chemically, or simply mixed together. Assign ecosystem toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in sections 4.1.4.2.1.1 and 4.2.4.2.1.1. If all radionuclides available to a particular pathway are assigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these radionuclides even if nonradioactive hazardous substances available to the pathway are assigned ecosystem toxicity factor values greater than 0. Similarly, if all nonradioactive hazardous substances available to the pathway are assigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned ecosystem toxicity factor values greater than 0.

7.2.3 Persistence. For radionuclides, evaluate the surface water persistence factor based solely on half-life; do not include sorption to sediments in the evaluation as is done for nonradioactive hazardous substances. Assign a persistence factor value from Table 4-10 (section 4.1.2.2.1.2) to each radionuclide based on half-life ($t_{1/2}$) calculated as follows:

$$t_{1/2} = \frac{1}{\frac{1}{r} + \frac{1}{v}}$$

where:

r=Radioactive half-life.

v=Volatilization half-life.

If the volatilization half-life cannot be estimated for a radionuclide from available data, delete it from the equation. Select the portion of Table 4-10 to use in assigning the persistence factor value as specified in section 4.1.2.2.1.2.

At sites containing mixed radioactive and other hazardous substances, evaluate the persistence factor separately for each radionuclide and for each nonradioactive hazardous substance, even if the available data indicate that they are combined chemically. Assign a persistence factor value to each radionuclide as specified in this section and to each nonradioactive hazardous substance as specified in section 4.1.2.2.1.2. When combined chemically, assign a single persistence factor value based on the higher of the two values assigned (individually) to the radioactive and nonradioactive components.

7.2.4 Selection of substance potentially posing greatest hazard. For each migration pathway (threat, aquifer, or watershed, as appropriate), select the radioactive substance or nonradioactive hazardous substance that potentially poses the greatest hazard based on its toxicity factor value, combined with the applicable mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factor values. Combine these factor values as specified in sections 2, 3, 4, and 6. For the soil exposure pathway, base the selection on the toxicity factor alone (see sections 2 and 5).

7.2.5 Hazardous waste quantity. To calculate the hazardous waste quantity factor value for sites containing radioactive substances, evaluate source hazardous waste quantity (see section 2.4.2.1) using only the following two measures in the following hierarchy (these measures are consistent with Tiers A and B for nonradioactive hazardous substances in sections 2.4.2.1.1 and 2.4.2.1.2):

- Radionuclide constituent quantity (Tier A).
- Radionuclide wastestream quantity (Tier B).

7.2.5.1 Source hazardous waste quantity for radionuclides. For each migration pathway, assign a source hazardous waste quantity value to each source having a containment factor value greater than 0 for the pathway being evaluated. For the soil exposure pathway, assign a source hazardous waste quantity value to each area of observed contamination, as applicable to the threat being evaluated. Allocate hazardous substances and hazardous wastestreams to specific sources (or areas of observed contamination) as specified in section 2.4.2.

7.2.5.1.1 Radionuclide constituent quantity (Tier A). Evaluate radionuclide constituent quantity for each source (or area of observed contamination) based on the activity content of the radionuclides allocated to the source (or area of observed contamination) as follows:

- Estimate the net activity content (in curies) for the source (or area of observed contamination) based on:
 - Manifests, or
 - Either of the following equations, as applicable:

$$N = 9.1 \times 10^{-12} \sum_{i=1}^n AC_i$$

where:

N=Estimated net activity content (in curies) for the source (or area of observed contamination).

V=Total volume of material (in cubic yards) in a source (or area of observed contamination) containing radionuclides.

AC_i =Activity concentration above the respective background concentration (in pCi/g) for each radionuclide i allocated to the source (or area of observed contamination).

n=Number of radionuclides allocated to the source (or area of observed contamination) above the respective background concentrations.

or,

$$N = 3.8 \times 10^{-12} \sum_{i=1}^n AC_i$$

where:

N=Estimated net activity content (in curies) for the source (or area of observed contamination).

V=Total volume of material (in gallons) in a source (or area of observed contamination) containing radionuclides.

AC_i =Activity concentration above the respective background concentration (in pCi/l) for each radionuclide i allocated to the source (or area of observed contamination).

n=Number of radionuclides allocated to the source (or area of observed contamination) above the respective background concentrations.

—Estimate volume for the source (or volume for the area of observed contamination) based on records or measurements.

—For the soil exposure pathway, in estimating the volume for areas of observed contamination, do not include more than the first 2 feet of depth, except: for those types of areas of observed contamination listed in Tier C of Table 5-2 (section 5.1.2.2), include the entire depth, not just that within 2 feet of the surface.

- Convert from curies of radionuclides to equivalent pounds of nonradioactive hazardous substances by multiplying the activity estimate for the source (or area of observed contamination) by 1,000.

- Assign this resulting product as the radionuclide constituent quantity value for the source (or area of observed contamination).

If the radionuclide constituent quantity for the source (or area of observed

contamination) is adequately determined (that is, the total activity of all radionuclides in the source and releases from the source [or in the area of observed contamination] is known or is estimated with reasonable confidence), do not evaluate the radionuclide wastestream quantity measure in section 7.2.5.1.2. Instead, assign radionuclide wastestream quantity a value of 0 and proceed to section 7.2.5.1.3. If the radionuclide constituent quantity is not adequately determined, assign the source (or area of observed contamination) a value for radionuclide constituent quantity based on the available data and proceed to section 7.2.5.1.2.

7.2.5.1.2 Radionuclide wastestream quantity (Tier B). Evaluate radionuclide wastestream quantity for the source (or area of observed contamination) based on the activity content of radionuclide wastestreams allocated to the source (or area of observed contamination) as follows:

- Estimate the total volume (in cubic yards or in gallons) of wastestreams containing radionuclides allocated to the source (or area of observed contamination).
- Divide the volume in cubic yards by 0.55 (or the volume in gallons by 110) to convert to the activity content expressed in terms of equivalent pounds of nonradioactive hazardous substances.
- Assign the resulting value as the radionuclide wastestream quantity value for the source (or area of observed contamination).

7.2.5.1.3 Calculation of source hazardous waste quantity value for radionuclides. Select the higher of the values assigned to the source (or area of observed contamination) for radionuclide constituent quantity and radionuclide wastestream quantity. Assign this value as the source hazardous waste quantity value for the source (or area of observed contamination). Do not round to the nearest integer.

7.2.5.2 Calculation of hazardous waste quantity factor value for radionuclides. Sum the source hazardous waste quantity values assigned to all sources (or areas of observed contamination) for the pathway being evaluated and round this sum to the nearest integer, except: if the sum is greater than 0, but less than 1, round it to 1. Based on this value, select a hazardous waste quantity factor value for this pathway from Table 2-6 (section 2.4.2.2).

For a migration pathway, if the radionuclide constituent quantity is adequately determined (see section 7.2.5.1.1) for all sources (or all portions of sources and releases remaining after a removal action), assign the value from Table 2-6 as the hazardous waste quantity factor value for the pathway. If the radionuclide constituent quantity is not adequately determined for one or more sources (or one or more portions of sources or releases remaining after a removal action), assign a factor value as follows:

- If any target for that migration pathway is subject to Level I or Level II concentration (see section 7.3), assign either the value from Table 2-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway.

• If none of the targets for that pathway is subject to Level I or Level II concentrations, assign a factor value as follows:

- If there has been no removal action, assign either the value from Table 2-6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value for that pathway.
- If there has been a removal action:
 - Determine values from Table 2-6 with and without consideration of the removal action.
 - If the value that would be assigned from Table 2-6 without consideration of the removal action would be 100 or greater, assign either the value from Table 2-6 with consideration of the removal action or a value of 100, whichever is greater, as the hazardous waste quantity factor value for the pathway.
 - If the value that would be assigned from Table 2-6 without consideration of the removal action would be less than 100, assign a value of 10 as the hazardous waste quantity factor value for the pathway.

For the soil exposure pathway, if the radionuclide constituent quantity is adequately determined for all areas of observed contamination, assign the value from Table 2-6 as the hazardous waste quantity factor value. If the radionuclide constituent quantity is not adequately determined for one or more areas of observed contamination, assign either the value from Table 2-6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value.

7.2.5.3 Calculation of hazardous waste quantity factor value for sites containing mixed radioactive and other hazardous substances. For each source (or area of observed contamination) containing mixed radioactive and other hazardous substances, calculate two source hazardous waste quantity values—one based on radionuclides as specified in sections 7.2.5.1 through 7.2.5.1.3 and the other based on the nonradioactive hazardous substances as specified in sections 2.4.2.1 through 2.4.2.1.5 (that is, determine each value as if the other type of substance was not present). Sum the two values to determine a combined source hazardous waste quantity value for the source (or area of observed contamination). Do not round this value to the nearest integer.

Use this combined source hazardous waste quantity value to calculate the hazardous waste quantity factor value for the pathway as specified in section 2.4.2.2, except: if either the hazardous constituent quantity or the radionuclide constituent quantity, or both, are not adequately determined for one or more sources (or one or more portions of sources or releases remaining after a removal action) or for one or more areas of observed contamination, as applicable, assign the value from Table 2-6 or the default value applicable for the pathway, whichever is greater, as the hazardous waste quantity factor value for the pathway.

7.3 Targets. For radioactive substances, evaluate the targets factor category as

specified in section 2.5 and sections 3 through 6, except: establish Level I and Level II concentrations at sampling locations as specified in sections 7.3.1 and 7.3.2.

For all pathways (and threats), use the same target distance limits for sites containing radioactive substances as is specified in sections 3 through 6 for sites containing nonradioactive hazardous substances. At sites containing mixed radioactive and other hazardous substances, include all sources (or areas of observed contamination) at the site in identifying the applicable targets for the pathway.

7.3.1 Level of contamination at a sampling location. Determine whether Level I or Level II concentrations apply at a sampling location (and thus to the associated targets) as follows:

- Select the benchmarks from section 7.3.2 applicable to the pathway (or threat) being evaluated.

• Compare the concentrations of radionuclides in the sample (or comparable samples) to their benchmark concentrations for the pathway (or threat) as specified in section 7.3.2. Treat comparable samples as specified in section 2.5.1.

- Determine which level applies based on this comparison.

• If none of the radionuclides eligible to be evaluated for the sampling location have an applicable benchmark, assign Level II to the actual contamination at that sampling location for the pathway (or threat).

• In making the comparison, consider only those samples, and only those radionuclides in the sample, that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may also be used for the human food chain threat of the surface water pathway as specified in sections 4.1.3.3 and 4.2.3.3.

7.3.2 Comparison to benchmarks. Use the following media specific benchmarks (expressed in activity units, for example, pCi/l for water, pCi/kg for soil and for aquatic human food chain organisms, and pCi/m³ for air) for making the comparisons for the indicated pathway (or threat):

- Maximum Contaminant Levels (MCLs)—ground water migration pathway and drinking water threat in surface water migration pathway.

• Uranium Mill Tailings Radiation Control Act (UMTRCA) standards—soil exposure pathway only.

• Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁶ individual cancer risk for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water or human food chain threats in surface water migration pathway; and soil exposure pathway).

-For the soil exposure pathway, include two screening concentrations for cancer—one for ingestion of surface materials and one for external radiation exposures from gamma-emitting radionuclides in surface materials.

Select the benchmark(s) applicable to the pathway (or threat) being evaluated. Compare the concentration of each radionuclide from the sampling location to its benchmark concentration(s) for that pathway (or threat). Use only those samples and only those radionuclides in the sample that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable radionuclide from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the radionuclide, assign Level I if the radionuclide concentration equals or exceeds the lowest applicable benchmark concentration. In addition, for the soil exposure pathway, assign Level I concentrations at the sampling location if measured gamma radiation exposure rates equal or exceed 2 times the background level (see section 7.1.1).

If no radionuclide individually equals or exceeds its benchmark concentration, but

more than one radionuclide either meets the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate a value for index I for these radionuclides as specified in section 2.5.2. If I equals or exceeds 1, assign Level I to the sampling location. If I is less than 1, assign Level II.

At sites containing mixed radioactive and other hazardous substances, establish the level of contamination for each sampling location considering radioactive substances and nonradioactive hazardous substances separately. Compare the concentration of each radionuclide and each nonradioactive hazardous substance from the sampling location to its respective benchmark concentration(s). Use only those samples and only those substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of one or more applicable radionuclides or other hazardous substances from any sample equals or exceeds its benchmark concentration, consider the

sampling location to be subject to Level I concentrations. If more than one benchmark applies to a radionuclide or other hazardous substance, assign Level I if the concentration of the radionuclide or other hazardous substance equals or exceeds its lowest applicable benchmark concentration.

If no radionuclide or other hazardous substance individually exceed a benchmark concentration, but more than one radionuclide or other hazardous substance either meets the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample, calculate an index I for both types of substances as specified in section 2.5.2. Sum the index I values for the two types of substances. If the value, individually or combined, equals or exceeds 1, assign Level I to the sample location. If it is less than 1, calculate an index J for the nonradioactive hazardous substances as specified in section 2.5.2. If J equals or exceeds 1, assign Level I to the sampling location. If J is less than 1, assign Level II.

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